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TITLE: Print system printer driver and printer

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Abstract Text - ABTX (1):

A printer driver is provided in a host computer. When a print job occurs, the printer driver automatically selects the **format** of a plotting command to be output to a printer. As the command **format,** there are available two kinds of **formats**: a high-level printer control language **format** (for example, PDL), and an intermediate code **format** expressed in an intermediate language. When the latter **format is selected, the printer driver** converts a plotting command from an application to an intermediate code and then outputs the intermediate code to the printer. The printer converts the intermediate code to another intermediate code specific to the printer by a very simple processing, and then develops the intermediate code to a bit image, thereby enabling high speed printing.

Brief Summary Text - BSTX (13):

In attaining the objects, according to the invention, there is provided a print system which includes a host computer and a printer connected with the host computer. In the present print system, the host computer includes a printer driver which is used to generate print job data including one or more plotting commands to be given to the printer, while the

printer driver further
includes intermediate level job data generating means used to generate
intermediate level print job data including plotting commands at least part of
which are expressed in the **format** of a first intermediate code. Also, the
printer includes intermediate code conversion means which is used to receive
intermediate level print job data and converts the plotting commands of the
intermediate level job data into a second intermediate code, and third
conversion means which is used to convert the second intermediate code into bit
image data for printing.

Brief Summary Text - BSTX (14):

According to the present print system, in the host computer, part or all of
the plotting commands are converted to the intermediate code **format** before
being transmitted to the printer. Therefore, in the printer, there can be
omitted a processing which converts the plotting commands written in a
high-level language to the intermediate code. In this manner, according to the
invention, since the intermediate code generation processing, which has been
conventionally performed only in the printer, can be shared by the host
computer, especially when the memory or CPU of the host computer has
capabilities to spare, and the printing speed of the printer can be enhanced.

Brief Summary Text - BSTX (19):

From the viewpoint of relieving the processing burden of the printer, it is
preferred that the first intermediate code to be generated by the printer
driver and the second intermediate code to be generated by the printer be in
the same **format**. However, there is a possibility that,

since the roles of the
two intermediate codes are different from each other, they can be different in
the details thereof. For example, the first intermediate code must include bit
image data on the individual characters to be plotted and on the individual
images to be plotted. On the other hand, in an ordinary printer, such bit
image data is managed at a different storage location from the intermediate
code and, therefore, the second intermediate code does not include such bit
image data.

Detailed Description Text - DETX (4):

The printer driver 9 converts the DDI call into a print command in an output
format which can be recognized by the page printer 3. The output **format**
includes two kinds of output **formats**. One of them is a high-level language
which is generally referred to as a printer control language and, in the
present embodiment, this corresponds to a Page Description Language (PDL). The
other output **format** is an intermediate (IM) code which is described in an
Intermediate Language (IML). This intermediate code is basically the same
format as an intermediate code which is generated from PDL by a controller 11
provided in the page printer 3, but they are a little different in the details
from each other. Hereinafter, in order to distinguish them from each other,
the intermediate code to be generated by the printer driver 9 is referred to as
a driver intermediate (DIM) code, whereas the intermediate code to be generated
by the page printer 3 is referred to as a printer intermediate (PIM) code.

Detailed Description Text - DETX (5):

The DIM code is different from the PIM code mainly in

that it includes image
bit map data on characters and bit images. That is, when a certain band, with
characters and bit images drawn therein, is described in an intermediate code,
within the printer, the bit map data on the respective characters and bit
images are placed in other memory areas than the PIM code, while pointers to
the respective characters and bit images in these memory areas are described in
the PIM code. On the other hand, in the DIM code, there are placed not only
the characters and bit images but also the bit map data on such characters and
bit images. In this case, in order to avoid the repetition of the bit map
data, for example, the following **format** can be employed. That is, only when
the characters and bit images appear for the first time within the band, the
bit map data on the characters and bit images are placed or registered in the
DIM code together with the identification numbers and the size specifications
thereof and, next, the identification numbers of the characters and bit images,
the coordinates thereof within the band, the specifications of the actually
used portions of the thus registered bit map data, and the like are described.
After that, each time the same characters and bit images appear again within
the same band, the identification numbers of the characters and bit images, the
coordinates thereof within the band, the specifications of the actually used
portions of the thus registered bit map data are described.

Detailed Description Text - DETX (12):

A system interface 23, on receipt of a DDI call for a new print job from the
API 8, decides a page mode and then allows a job data generation module 25 to
execute a plotting processing in accordance with the DDI call. Here, "to

decide a page mode" means to decide whether the output **format** of a print command to be output to the printer is a PDL **format** or a DIM code **format**. A mode to output the print command in the PDL **format** is referred to as a "printer page mode", whereas a mode to output the print command in the DIM code **format** is referred to as a "driver page mode". A method for deciding the page mode will be described in detail later.

Detailed Description Text - DETX (13):

In the printer page mode, the job data generation module 25 executes a plotting processing which corresponds to a DDI call delivered from the system interface 23 and, as a result of this, a print command chain relating to a print job (which is hereinafter referred to as job data) is generated in such **format** as shown in FIG. 3(A).

Detailed Description Text - DETX (20):

FIG. 3(B) shows an example of the plotting command that is expressed in the IMM call and, in this example, a page is divided into one or more bands and the plotting command 55 of each band is expressed in the IMM call. To the heads of the plotting commands 55 of the respective bands, there are attached band number declarations 53 which show the start of the respective bands. The band-number declarations 53 are respectively expressed in the PDL. Therefore, from the IMM driver 27, there are output job data in a **format** obtained by replacing the portions of the job data of FIG. 3(A) that correspond to the plotting commands 47 of the respective pages with such expressions as are shown in FIG. 3(B). By the way, in the present job data, the driver page mode is specified within the printer initialize command 45.

Detailed Description Text - DETX (23):
On the other hand, with respect to the plotting command 55 in the **format** of the IMM call shown in FIG. 3(B), the replay module 31 calls the plotting function of the IMM module 33. The plotting function of the IMM module 33 converts the present plotting command 55 to a DIM code (that is, a driver intermediate code).

Detailed Description Text - DETX (25):
Therefore, from the replay module 31, there is output job data in the **format** that is obtained by replacing the plotting command 47 of each page of the job data shown in FIG. 3(A) with one shown in FIG. 3(B) and further by replacing the plotting command 55 of each band shown in FIG. 3(B) with one shown in FIG. 3(C).

Detailed Description Text - DETX (37):
Now, referring again to FIG. 6, if the driver page mode is selected, then the banding decision processing (S4) is executed. At first, the number of bytes of a memory necessary to store DIM codes corresponding to one page is estimated, the estimated byte number is set in a variable **P**, and the initial value 1 of the band number is set in a variable n (S13). Next, it is checked whether a **P** byte memory can be actually secured or not (S14). If it is found that n=1, then an unbanding processing (that is, a page is not divided into two or more bands but is processed as a band) is decided (S16). Here, the larger the size of the **P** byte is, the less frequently the plotting element is divided, which reduces the number of times of replay to thereby reduce the driver

processing time, resulting in improved performance of the overall processing.
On the other hand, when the **P** byte cannot be secured, **P** is divided by 2 and n
is doubled (S17) and, after that, it is checked whether or not the **P** byte can
be secured (S13). If the **P** byte cannot be secured, then **P** is divided by 2 and
n is doubled again (S17). This operation is executed repeatedly until the **P**
byte can be secured. If the **P** byte can be secured, then the memory area of the
P byte is secured as a buffer for the DIM code and there is decided such a
banding processing as can divide a page by the band number that is indicated by
the current n (S18). By the way, in the case of the printer page mode, since
the plotting contents are described in the **PDL** in pages, an unbanding
processing is inevitably decided.

Detailed Description Text - DETX (51):
RGB multivalued band developing section 115 develops the printer
intermediate code 125 into a multigradation **raster** image (RGB multivalued band
image) 127 of RGB expression at each band and registers it in the memory 123.
CMYK multivalued band developing section 115 converts RGB multivalued band
image 127 of each band into a multigradation **raster** image 129 of CMYK
expression and registers it in the memory 123. The binarization processing
section 119 generates a binary signal, which expresses whether or not a CMYK
ink dot is hit at each dot position, from CMYK multigradation **raster** image 129
and sends it to a printing engine 121. The printing engine 121 prints a
document image on a sheet of paper in accordance with the binary signal.

Detailed Description Text - DETX (52):

In general, after the printing engine has been set in motion, it continues printing at a constant printing speed hereinafter. Therefore, the image development processing conducted by the band developing sections 115, 117 must not be delayed with respect to this speed. Accordingly, if the processing speed of the band developing sections 115, 117 is sufficiently high, the printing engine 121 may start printing at a point of time when image development of the first one band has been completed. However, in order to keep the printing operation to be safe, the printing engine 121 may start printing after image development of predetermined plural bands or image development of one page has been completed. In the latter case, in order to save the memory 123, it is preferable that the developed **raster** image is compressed and stored. Time to start printing, at which the printing engine 121 is started after the image development of bands has been completed, may be controlled in accordance with the type of a document to be printed, for example, whether color or monochrome, whether a natural image such as a photograph is contained or the image is composed of only a text and figure, whether or not the resolution is high, and whether or not the page size is large.

Claims Text - CLTX (1):

1. A print system comprising a host computer and a printer connected to the host computer, wherein said host computer includes a printer driver used to generate print job data including plotting commands to be given to said printer, said printer driver includes intermediate level job data generation means used to generate intermediate level job data

including plotting commands
at least part of which is expressed in a first intermediate code **format,** and
said printer includes intermediate code convert means used to receive said
intermediate level print job data and convert said plotting commands to a
second intermediate code **format,** and third convert means used to convert said
second intermediate code to bit map image data for printing.

Claims Text - CLTX (2):
2. A print system as set forth in claim 1 wherein said intermediate level
print job data includes specification information specifying which plotting
commands are expressed in said first intermediate code **format,** and said
intermediate code convert means distinguishes said plotting commands in said
first intermediate code **format** from others in accordance with said
specification information.

Claims Text - CLTX (6):
6. A print system as set forth in claim 1, wherein said first intermediate
code **format** includes bit map image data on characters or images to be plotted,
whereas said second intermediate code **format** does not include bit map image
data on characters or images to be plotted.

Claims Text - CLTX (7):
7. A print system as set forth in claim 1, wherein said intermediate level
job data generation means includes pre-develop means used to pre-develop bit
map image data from said plotting commands expressed in said first intermediate
code **format**.

Claims Text - CLTX (8):
8. A printing method using a host computer and a printer connected to the host computer, said method comprising the following steps: generating, in said host computer, intermediate level print job data including plotting commands which are to be given to said printer and at least part of which is expressed in a first intermediate code **format,** and then transmitting said generated print job data to said printer; receiving, in said printer, said intermediate level print job data and converting said plotting commands to a second intermediate code; and converting, in said printer, said second intermediate code to bit map image data for printing.

Claims Text - CLTX (9):
9. A printer driver for generating print job data including plotting commands to be given to a printer, said printer driver comprising: intermediate level job data generation means for generating intermediate level job data including plotting commands, at least part of which is expressed in a first intermediate code **format;** high-level job data generation means for generating high-level job data including plotting commands, all of which are expressed in a high-level printer control language; and mode select means for selecting one of said intermediate level job data generation means and said high-level job data generation means.

Claims Text - CLTX (10):
10. A program medium carrying a printer driver computer program for generating print job data including plotting commands to be given to printer, characterized in that said program medium carries a group of instructions for

generating intermediate level job data including plotting commands at least a
part of which is expressed in a first intermediate code **format,** in such a
manner that said group of instructions can be read and understood by a
computer; a group of instructions for generating high-level job data including
plotting commands, all of which are expressed in a high-level printer control
language; and a group of instructions for selecting one of said intermediate
level job data generation means and said high-level job data-generation means.

Claims Text - CLTX (11):

11. A printer, comprising: means for receiving print job data including
plotting commands; intermediate code convert means for, when said plotting
commands of said received print job data are expressed in first intermediate
code **format,** converting said first intermediate code to a second intermediate
code; and third means for converting said second intermediate code to bit map
image data for printing.

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Current US Cross Reference Classification - CCXR (1):

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Current US Cross Reference Classification - CCXR (2):

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